Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

March 16, 2012

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Licensee Event Report 390/2012-001, Failure to Meet Technical Specifications due to Issues Associated with Vital Battery Surveillance Program**

This submittal provides Licensee Event Report (LER) 390/2012-001. This LER documents an incident where the requirements of several Technical Specifications were not met due to issues associated with the vital battery surveillance program. The condition is reported as an LER in accordance with 10CFR50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(vii).

There are no regulatory commitments in this letter. Please direct any questions concerning this matter to Donna Guinn, WBN Site Licensing Manager, at (423) 365-1589.

Respectfully,

D. E. Grissette
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

Enclosure
cc (Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Watts Bar Nuclear Plant

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Failure to Meet Technical Specifications due to Issues Associated with Vital Battery Surveillance Program

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
02	13	2011	2012	- 001	- 00	03	16	2012	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☒ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Stan Day, Licensing Engineer	(423) 751-7221

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
D	EJ	BTRY	C173	N					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On 01/17/2012, TVA determined that Vital Battery IV (VB4) was inoperable between 02/13/11 and 12/03/2011. This was based on an independent analysis of test data from the performance of Surveillance Requirement (SR) 3.8.4.14 for VB4 conducted on 02/10/2011 that indicated the actual battery capacity did not meet the SR 3.8.4.14 acceptance criterion. On 11/21/2011, VB3 did not meet the SR 3.8.4.14 acceptance criterion. On 03/14/2012, TVA concluded that VB3 and VB4 may have been inoperable for unknown periods of time prior to the failed capacity tests. As a result, there were times when VB3 and VB4 were required to be operable to comply with Technical Specification (TS) 3.8.4 and TS 3.8.5, and WBN, Unit 1 failed to meet the applicable requirements of TS 3.8.4, TS 3.8.5 and LCO 3.0.4. Also, VB3 and VB4 may have been inoperable concurrently; thus, the requirements of LCO 3.0.3 may not have been met.

During the time periods discussed above, VB3 and VB4 were capable of performing their safety function.

Preliminarily, TVA determined that a manufacturing deficiency was the direct cause of the unexpected degradation of VB3 and VB4. The causes were inadequacies in the oversight of the battery surveillance program, and issues with the battery capacity test procedure. Corrective actions include changes to the battery test program, procedure revisions, and training of plant personnel.

NARRATIVE

I. PLANT CONDITIONS

On 11/21/2011 (the date Vital Battery III (VB3) failed the capacity test conducted in accordance with Surveillance Requirement (SR) 3.8.4.14), Unit 1 was operating in Mode 1 at 100% power.

On 01/17/2012 (the date of discovery of the Vital Battery IV (VB4) inoperability), Unit 1 was operating in Mode 1 at 100% power.

For the time period between 02/13/2011 and 12/03/2011, the following table establishes when VB4 was required to be operable to comply with Technical Specifications 3.8.4 and 3.8.5, the associated Mode or specified condition of operation, and applicable Rated Thermal Power (RTP).

Table 1 – Plant Conditions Associated with VB IV Inoperability

Time Period (Date and Time)	Mode or Condition	RTP (%)	Applicable Technical Specification
02/13/2011 at 1821 through 04/04/2011 at 0741	1, 2, 3, 4	100 - 000	3.8.4 – VB4 required to be operable Condition Prohibited by TS Existed
04/04/2011 at 0741 through 04/16/2011 at 0925	5 and 6	000	3.8.5 – VB4 required to be operable Condition Prohibited by TS Existed
04/16/2011 at 0925 through 04/29/2011 at 2124	No Mode	000	VB4 not required to be operable No Condition Prohibited by TS Existed regarding VB4
04/29/2011 at 2124 through 05/13/2011 at 0558	5 and 6	000	3.8.5 – VB4 required to be operable Condition Prohibited by TS Existed
05/13/2011 at 0558 through 06/27/2011 at 1647	1, 2, 3, and 4	100 - 000	3.8.4 – VB4 required to be operable Condition Prohibited by TS Existed
06/27/2011 at 1647 through 07/09/2011 at 0501	1	Various	VB4 removed from service – VB5 aligned to Vital Battery Board IV No Condition Prohibited by TS Existed regarding VB4
07/09/2011 at 0501 through 12/03/2011 at 0408	1, 2, and 3	100 - 000	3.8.4 – VB4 required to be operable Condition Prohibited by TS Existed

NARRATIVE

I. PLANT CONDITIONS (continued)

Note: VB4 was not required to be operable for the time periods of: 1) 04/16/2011 at 0925 through 04/29/2011 at 2124 when the plant was in the "No Mode" condition, and 2) 06/27/2011 at 1647 through 07/09/2011 at 0501 when VB4 was removed from service and Vital Battery V (VB5) was aligned to Vital Battery Board IV.

II. DESCRIPTION OF EVENT

A. Event

VB3 Description of Event

On 11/21/2011, a battery capacity test was completed for VB3 [Energy Industry Identification System (EIIS) Code EL] in accordance with SR 3.8.4.14. A battery capacity of approximately 70% was recorded, which did not meet the acceptance criterion of ≥ 80% for SR 3.8.4.14.

At the time of discovery, VB3 was removed from service, and was not being credited to meet TS 3.8.4. VB5 was aligned to Vital Battery Board III.

NUREG-1022 provides the following guidance regarding discrepancies identified during surveillance tests: "...discrepancies found in technical specifications surveillance tests should be assumed to occur at the time of the test unless there is firm evidence, based on a review of relevant information (e.g., the equipment history and the cause of failure) to indicate that the discrepancy occurred earlier."

For VB3, the previous capacity test conducted in accordance with SR 3.8.4.14 on 10/31/2005 established a battery capacity of 109.85%. A review of maintenance history and the equipment failure analysis did not identify a specific event or action that occurred between 10/31/2005 (previous successful capacity test for VB3) and 11/21/2011 (failed capacity test for VB3) that rendered VB3 inoperable when aligned to a Vital Battery Board.

Despite the lack of firm evidence, on 03/14/2012, TVA conservatively concluded that VB3 may have been inoperable at some point in time prior to 11/21/2011. However, TVA cannot identify when this inoperability occurred. Thus, for an undefined period of time that VB3 was credited as one of the channels of vital DC to comply with the requirements of LCO 3.8.4 or LCO 3.8.5, a condition prohibited by Technical Specifications may have existed.

During the time periods discussed above, VB3 was capable of performing its safety function (See Section V of this LER for detailed information).

VB4 Description of Event

On 11/30/2011, Problem Evaluation Report (PER) 468950 was initiated to determine the cause of the unexpected degradation of VB3 and VB4.

On 02/10/2011, a battery capacity test was completed for VB4 [EIIS Code EL] in accordance with SR 3.8.4.14. A battery capacity of 82.5% was recorded. The battery was considered operable, because the battery capacity exceeded the acceptance criterion of ≥ 80% for SR 3.8.4.14.

II. DESCRIPTION OF EVENT (continued)

As part of the root cause analysis for PER 468950, an independent engineering analysis of the completed surveillance package for VB4 from 02/10/2011 was completed on 01/17/2012. It determined that the recorded results for the VB4 battery capacity test conducted on 02/10/2011 were incorrect, and that the capacity of VB4 was actually 79.87%. VB4 was determined to be inoperable, because the VB4 battery capacity test results did not meet the acceptance criterion of SR 3.8.4.14.

For VB4, the previous capacity test conducted in accordance with SR 3.8.4.14 on 09/23/2005 established a battery capacity of 108.75%. Despite the lack of firm evidence, on 03/14/2012, TVA conservatively concluded that VB4 may have been inoperable at some point in time prior to failing the capacity test performed in accordance with SR 3.8.4.14 on 02/10/2011.

In addition to this unknown period of time, Section I of this LER establishes periods of time when VB4 was inoperable, and it was required to be operable to comply with TS 3.8.4 and TS 3.8.5.

Thus, during periods of time that VB4 was inoperable and it was credited as one of the channels of vital DC to comply with the requirements of LCO 3.8.4 or LCO 3.8.5, a condition prohibited by Technical Specifications existed.

During the time periods discussed above, VB4 was capable of performing its safety function (See Section V of this LER for detailed information).

Conditions Reportable in accordance with 10 CFR 50.73(a)(2)(i)(B)

The following events are reportable as an LER in accordance with 10 CFR 50.73(a)(2)(i)(B):

- Failure to meet SR 3.8.4.14 for VB4 within the specified frequency.
- When VB4 was required to be operable during the time periods identified in the Table in Section I of this LER, WBN, Unit 1 did not enter the applicable Conditions and Required Actions of the applicable TS (i.e., TS 3.8.4 or TS 3.8.5), and did not perform the applicable Required Actions within the applicable Completion Times.
- TVA conservatively concluded that VB3 and VB4 may have been inoperable for an undefined period of time prior to the failed capacity tests. During this time, WBN, Unit 1 did not enter the applicable Conditions and Required Actions of the applicable TS (i.e., TS 3.8.4 or TS 3.8.5), and did not perform the applicable Required Actions within the applicable Completion Times.
- As a result of the above, multiple inappropriate Mode changes occurred due to the unknown inoperability of VB4 and may have occurred due to the unknown inoperability of VB3, when WBN, Unit 1 entered a Mode or specified condition of applicability for TS 3.8.4 or TS 3.8.5 while ascending in Modes following the refueling outage.

NARRATIVE

II. DESCRIPTION OF EVENT (continued)

- If the VB3 and VB4 were inoperable concurrently while in Modes 1, 2, 3, or 4, then TS 3.8.4 does not provide a condition to address that situation. Thus, the requirements of LCO 3.0.3 may not have been met.

Condition Reportable in accordance with 10 CFR 50.73(a)(2)(vii)

VB3 and VB4 represent two independent channels in the vital DC system. Since the possibility existed that both VB3 and VB4 were inoperable concurrently due to the same condition, the condition is reportable in accordance with 10 CFR 50.73(a)(2)(vii).

B. Inoperable Structures, Components, or Systems that Contributed to the Event

VB3 and VB4 failed SR 3.8.4.14.

C Date and Approximate Times of Major Occurrences

Table 2 – VB3 Events

Date	Time	VB3 Events
10/31/2005		VB3 completed capacity test in accordance with SR 3.8.4.14. Recorded battery capacity was 109.85%. Acceptance criterion is ≥ 80%.
02/25/2011		VB3 successfully completed service test in accordance with SR 3.8.4.13.
04/16/2011	0925	No Mode (Core offloaded in spent fuel pool during refueling outage).
04/29/2011	2124	Mode 6 entered (Initial entry into a Mode of Applicability for TS 3.8.5).
05/13/2011	0558	Mode 4 entered (Initial entry into a Mode of Applicability for TS 3.8.4).
11/20/2011	1852	VB3 removed from service. VB5 aligned to Vital Battery Board III at 1854.
11/21/2011		VB3 failed battery capacity test performed in accordance with SR 3.8.4.14. At the time of the test, VB5 was aligned to Vital Battery Board III.
11/30/2011		PER 468950 was initiated to determine the cause for the unexpected degradation of VB3 and VB4 capacity.
12/02/2011	2326	VB3 replaced with new battery and returned to service. VB3 tested in accordance with service test SR 3.8.4.13. VB3 met the acceptance criterion (≥ 105 Volts (Vdc)). Factory capacity test performed by C&D Technologies was credited for meeting the acceptance criterion for SR 3.8.4.14.
12/19/2011		Service test performed on the VB3 that was in service prior to 12/02/2011 utilizing a single unit load profile as described in Section V of this LER. VB3 met the acceptance criterion (≥ 105 Vdc).
3/14/2012		TVA conservatively concluded that VB3 may have been inoperable for an unknown time period prior to 11/21/2011.

II. DESCRIPTION OF EVENT (continued)

Table 3 – VB4 Events

Date	Time	VB4 Events
09/23/2005		VB4 completed capacity test in accordance with SR 3.8.4.14. Recorded battery capacity was 108.75%. Acceptance criterion is ≥ 80%.
08/11/2009		VB4 successfully completed service test in accordance with SR 3.8.4.13.
02/08/2011	1035	VB4 removed from service. VB5 aligned to Vital Battery Board IV at 1039.
02/10/2011		VB4 completed capacity test SR 3.8.4.14. Recorded battery capacity was 82.5%. Acceptance criterion is ≥ 80%.
02/13/2011	1821	VB4 returned to service. VB5 placed in standby alignment.
04/16/2011	0925	No Mode (Core offloaded in spent fuel pool during refueling outage).
04/29/2011	2124	Mode 6 entered (Initial entry into a Mode of Applicability for TS 3.8.5).
05/13/2011	0558	Mode 4 entered (Initial entry into a Mode of Applicability for TS 3.8.4).
06/27/2011	1647	VB4 removed from service. VB5 aligned to Vital Battery Board IV.
06/27/2011		VB4 failed battery service test in accordance with SR 3.8.4.13.
07/06/2011		Replaced the eight weakest cells in VB4 and re-tested VB4 in accordance with SR 3.8.4.13. VB4 met service test acceptance criterion (≥ 105 Vdc) with a terminal voltage of 105.4 Vdc.
07/09/2011	0501	VB4 returned to service. VB5 placed in standby alignment.
11/30/2011		PER 468950 was initiated to determine the cause for the unexpected degradation of VB3 and VB4 capacity.
12/03/2011	0408	VB4 removed from service. VB5 aligned to Vital Battery Board IV at 0409.
12/07/2011		Service test performed on VB4 with the eight new cells that had been installed on 07/06/11 utilizing a single unit load profile as described in Section V of this LER. VB4 met the acceptance criterion (≥ 105 Vdc).
01/06/2012		Service test performed on VB4 with the eight weak cells that had been removed on 07/06/11 utilizing a single unit load profile as described in Section V of this LER. VB4 met the acceptance criterion (≥ 105 Vdc).
01/15/2012		Replaced VB4 with new battery. VB4 tested in accordance with service test SR 3.8.4.13. VB4 met the acceptance criterion (≥ 105 Vdc) with a terminal voltage of 112.1 Vdc. Factory capacity test performed by C&D Technologies was credited for meeting the acceptance criterion for SR 3.8.4.14.
01/15/2012	0116	VB4 returned to service. VB5 placed in standby alignment.
01/17/2012		Independent engineering analysis of the completed surveillance package for VB4 indicated that the actual battery capacity calculated on 02/10/2011 was 79.87%. This is less than the SR 3.8.4.14 acceptance criterion of ≥ 80%. This event was entered into the Corrective Action Program as PER 492211.
3/14/2012		TVA conservatively concluded that VB4 may have been inoperable for an unknown time period prior to 02/10/2011

NARRATIVE

II. DESCRIPTION OF EVENT (continued):

D. Other Systems or Secondary Functions Affected

There were no other systems or secondary functions affected.

E. Method of Discovery

The VB3 inoperability was discovered on 11/21/2011 following performance of a battery capacity test in accordance with SR 3.8.4.14.

During the performance of the root cause analysis for PER 468950 to determine the cause of the unexpected degradation of VB3 and VB4, an independent engineering analysis of the completed surveillance package for VB4 determined that the recorded results for the VB4 battery capacity test were incorrect, and that the battery capacity for VB4 was actually 79.87%.

F. Operator Actions

No Operator actions were required.

At the time of discovery of the VB3 inoperability (11/21/2011), VB3 was removed from service, and was not being credited to meet TS 3.8.4. VB5 was aligned to Vital Battery Board III. VB3 was subsequently replaced with a new battery that met the surveillance requirements prior to being restored to service.

At the time of discovery of the VB4 inoperability (01/17/2012), VB4 had been replaced with a new battery that met the surveillance requirements.

G. Safety System Responses

At no time during this reporting period was Vital Battery Board III or Vital Battery Board IV incapable of performing its design bases function (See Section V of this LER for detailed information).

VB3 and VB4 are only required to support plant safety loads if: 1) its associated battery charger fails; 2) a loss of offsite power occurs; or 3) a station blackout occurs. No plant transient occurred that would have required VB3 or VB4 to perform its intended safety function.

III. CAUSE OF EVENT

Cause of Unexpected Degradation of VB3 and VB4

TVA determined that the direct cause for the unexpected degradation of VB3 and VB4 was a manufacturing deficiency associated with the forming of the positive plates for the VB3 and VB4 cells (paste curing process or paste formulation). This determination was based on the initial results of the destructive failure analysis. Additional evaluation by the battery manufacturer, C&D Technologies, is ongoing to confirm the failure mechanism that caused the unexpected decrease in the capacity of VB3 and VB4. After the final determination of the cause of the unexpected degradation in battery capacity, TVA will review the issue in accordance with 10 CFR Part 21.

NARRATIVE

III. CAUSE OF EVENT (continued)

TVA determined that the root causes for the degraded battery capacity issue were:

1) The organization's Risk Assessment System was less than adequate to assess the operability of the station's vital batteries and failed to identify the degraded capacity of VB3 and VB4; and

2) The organization did not promptly identify, fully analyze and resolve in a timely manner unexpected safety significant trend and test data concerning vital battery operability.

Cause of Conditions Prohibited by Technical Specifications Associated with VB4 Inoperability

VB4 was inoperable during the time periods identified in Sections I and II of this LER due to unidentified errors in the battery capacity calculations that were completed on 02/10/2011. The errors were discovered as part of an independent engineering analysis of the completed surveillance package for VB4 completed on 01/17/2012. The independent engineering analysis indicated that the actual battery capacity was 79.87%. This is less than the SR 3.8.4.14 acceptance criterion of ≥ 80% of manufacturer rating.

There were several problems with both the test equipment and procedure that caused VB4 recorded capacity (82.5%) to be in error. The errors were due to inaccurate calculation of the time interval that battery cell No. 54 was jumpered out of the circuit during the four hour capacity discharge test and rounding errors where times were not calculated to the nearest second. These errors resulted in greater recorded amp-hour capacity than what actually existed. Battery Cell No. 54 was jumpered out due to low cell voltage.

IV. ANALYSIS OF THE EVENT

VB3 and VB4 Unexpected Degraded Capacity

WBN's oversight of the vital battery surveillance program was less than adequate. WBN's Risk Assessment System with respect to the vital batteries consists of implementation of the surveillance program. Additional elements that are used to monitor and assess the condition of the vital battery program are the System Health Report, the Operational Experience program, and the Margin Management program.

WBN's organizational response to the VB4 events in February and June was less than adequate. Site management failed to recognize or understand the potential significance of vital battery degradation. The organizational response to the 02/10/2011 VB4 capacity test failure was less than adequate to ensure VB4 would not fail the 06/27/2011 service test in accordance with SR 3.8.4.13. The organizational response to the 06/27/2011 VB4 service test failure was inadequate to ensure VB3 would not fail the 11/21/2011 capacity test in accordance with SR 3.8.4.14.

IV. ANALYSIS OF THE EVENT (continued)

Preliminarily, TVA determined that the direct cause of the unexpected degradation of VB3 and VB4 to a state in which it could not meet the acceptance criterion was a manufacturing deficiency associated with the forming of the positive plates for VB3 and VB4 cells (paste curing process or paste formulation). This determination is based on the initial results of the destructive failure analysis. Additional evaluation by the battery manufacturer, C&D Technologies, is ongoing to confirm the failure mechanism that caused the unexpected decrease in the capacity of VB3 and VB4.

VB4 Conditions Prohibited by Technical Specifications

The computer system used for battery testing is obsolete. New test equipment was available, but training and test procedures to allow the use of new equipment had not been completed. Use of the obsolete test equipment and procedure deficiency led to inaccurate test results. Specifically, the test procedures did not specify that the time required to jumper out a defective cell(s) must be subtracted from the total discharge time when calculating battery capacity. In addition, WBN non-conservatively rounded test data during the VB4 capacity test.

The original determination of operability for VB4 was based on the original capacity test results for VB4. If the test procedure had determined VB4's capacity correctly, VB4 would not have been returned to service until the issue was resolved. Errors in the testing practices as described above caused TVA to not recognize that VB4 was outside the TS acceptance criterion of SR 3.8.4.14.

V. ASSESSMENT OF SAFETY CONSEQUENCES

Introduction

The vital 125V DC power system is a Class 1E system composed of four redundant channels (Channels I and III are associated with Train A and Channels II and IV are associated with Train B). Each channel consists of a lead-acid-calcium battery, battery charger, distribution board, and the required cabling, instrumentation and protective features. These four channels provide control power to the Class 1E 6.9 kV shutdown boards, 480V motor control centers, inverters and emergency DC lighting systems.

Each vital battery has adequate storage capacity to carry the required load continuously for at least 4 hours in the event of a loss of all AC power (station blackout) without an accident or for 30 minutes with an accident considering a single failure. Each battery board can also be aligned to the fifth vital battery system. The fifth 125V DC Vital Battery System can serve as a replacement for any one of the four 125V DC vital batteries during testing, maintenance, and outages with no loss of system reliability under any mode of operation.

The vital batteries preventative maintenance program has been maintained in accordance with manufacturer's recommendations. In addition to the capacity and service tests, battery voltage is checked daily and the battery pilot cell temperature is checked weekly. Individual cell voltages and specific gravity checks are performed quarterly, and the battery circuit connection resistances are checked annually.

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NARRATIVE

V. ASSESSMENT OF SAFETY CONSEQUENCES (continued)

Surveillance testing is performed for all vital batteries in accordance with SR 3.8.4.13 and SR 3.8.4.14.

- The test conducted in accordance with SR 3.8.4.13 is called the service test in this LER. It is a timed 4 hour discharge test that uses a load profile based on WBN's design basis event's equipment load requirements for safe shutdown. The result is the battery's voltage reading at the 4 hour mark which is compared to the SR 3.8.4.13 acceptance criterion of ≥ 105 Vdc.

- The test conducted in accordance with SR 3.8.4.14 is called the capacity test in this LER. It is a timed discharge at a constant load rate and is terminated when the overall cell voltage reaches 105 Vdc. The results are given as a capacity percentage value with respect to the designed capacity of the battery. The SR 3.8.4.14 acceptance criterion is ≥ 80%.

VB3 Discussion

On 12/19/2011, a service test was performed on the VB3 that was replaced on 12/02/2012. This service test was a battery discharge test using a single unit load profile, which consists of Unit 1 loads, common loads, and loads transferred from Unit 2 to Unit 1. VB3 met the acceptance criterion (≥ 105 Vdc) with a terminal voltage of 115.1 Vdc. This test demonstrated that VB3 had sufficient stored energy to meet design bases accident load demands for the time frame between 02/25/2011 when the last service test was performed and 11/21/2011 when VB3 was removed from service for replacement.

This test demonstrated VB3 was capable of performing its safety function for the worst case scenario which is the four-hour station blackout.

VB4 Discussion

As indicated in Section II.C of this LER, VB4 met the acceptance criterion of SR 3.8.4.13 on 07/06/2011 with a margin of 0.4 Vdc. This service test used a two unit load profile. A two unit load profile is conservative, because it assumes not only Unit 1 loads and common loads but also Unit 2 loads. Unit 2 is currently under construction, and all of its loads have not been transferred to VB4.

On 12/07/2011, a service test was performed on VB4 with the eight new cells that had been installed on 07/06/2011. This service test was a battery discharge test using a single unit load profile, which consists of Unit 1 loads, common loads, and loads transferred from Unit 2 to Unit 1. VB4 met the acceptance criterion (≥ 105 Vdc) with a terminal voltage of 114.9 Vdc. This test demonstrated that VB4 had sufficient stored energy to meet design bases accident load demands for the time frame between 07/09/2011 and 12/03/2011.

On 01/06/2012, a service test using a single unit load profile was performed on VB4 using the eight weak cells that had been removed on 07/06/2011. VB4 met the acceptance criterion (≥ 105 Vdc) with a terminal voltage of 111.9 Vdc. This test demonstrated that VB4 had sufficient stored energy to meet design bases accident load demands for the time frame between 02/13/2011 and 06/27/2011.

These tests demonstrated VB4 was capable of performing its safety function for the worst case scenario which is the four-hour station blackout.

V. ASSESSMENT OF SAFETY CONSEQUENCES (continued)

Extent of Condition Considerations

Based on the findings regarding the VB4 capacity test, extent of condition was considered for previous capacity tests performed on VB1, VB2, VB3, VB5 and the Emergency Diesel Generator (EDG) batteries. The 02/10/2011 capacity test for VB4 was the only time a battery cell was jumpered out resulting in amp-hour capacity errors. Rounding errors were discovered where computer printouts were not available to record the test's total discharge times. None of the rounding errors identified by this review affected the acceptance criterion in the applicable test packages. The rounding errors have been corrected in the permanent records.

The vital batteries and the EDG batteries were replaced or are scheduled to be replaced as follows:

- VB1 and VB2 were replaced in 2009
- VB3 was replaced in 2011
- VB4 was replaced in 2012
- VB5 is scheduled to be replaced in late 2012. On 02/22/2012, a capacity test in accordance with SR 3.8.4.14 established that VB5's capacity was 106.19%.
- The EDG batteries were replaced in 2006.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

There were no immediate corrective actions required for the VB3 inoperability. At the time of discovery of the VB3 inoperability (11/21/2011), VB3 was removed from service, and was not credited to meet TS 3.8.4. VB5 was aligned to Vital Battery Board III. VB3 was subsequently replaced with a new battery that met the surveillance requirements prior to being restored to service.

There were no immediate corrective actions required for the VB4 inoperability. At the time of discovery of the VB4 inoperability (01/17/2012), a new battery that met the surveillance requirements was installed as VB4.

B. Corrective Actions to Prevent Recurrence of Unexpected Battery Degradation

1. NPG-SPP-06.9.2, Attachment 2, "SI Scheduling Exception Form," was revised to require Plant Manager or Shift Manager approval prior to scheduling surveillance instructions deep into the grace period (> 50% of grace period).

2. Perform the modified performance discharge test specified in SR 3.8.4.14 on an 18 month frequency instead of a 60 month frequency. A License Amendment Request to modify SR 3.8.4.13 would be required to change Note 1 of SR 3.8.4.13 to permit the modified performance discharge test of SR 3.8.4.14 to be performed in lieu of SR 3.8.4.13 every 18 months.

3. Incorporate a Case Study of the 2011 events involving the vital batteries with specific examples of the organization's lessons learned into the department's recurring continuing training program.

VI. CORRECTIVE ACTIONS (continued)

4. Revise PER Screening Committee qualification training to incorporate the Plant Safety Committee's roles and responsibilities and a familiarity/overview for Margin Management, Functional Evaluation (Degraded/Non-Conforming Conditions), Operability, and Reportability.

C. Corrective Actions to Prevent Recurrence of Inadequate Test Procedure

1. Revise existing vital battery surveillance instruction to use the new Alber BCT-2000/128 battery test equipment.

2. Provide training regarding the use of the new Alber BCT-2000/128 battery test equipment to appropriate personnel.

3. Revise existing vital battery surveillance instructions to ensure that the battery capacity calculation accounts for periods when the discharge test is interrupted and that all values are recorded to the nearest second.

VII. ADDITIONAL INFORMATION

A. Failed Components

VB3 and VB4 failed the SR 3.8.4.14 acceptance criterion. Preliminarily, TVA determined that a manufacturing deficiency was the direct cause of the unexpected degradation of VB3 and VB4. Additional evaluation by the battery manufacturer, C&D Technologies, is ongoing to confirm the failure mechanism that caused the unexpected decrease in the capacity of VB3 and VB4. The batteries are C&D Model LCUN-33.

In accordance with Section 5.1.5 of NUREG-1022, a supplement will not be provided to report the results of the evaluation, because it will not significantly change the course, significance, implications, or consequences of the event or result in substantial changes in the planned corrective actions for the events described in this LER.

B. Previous LERs on Similar Events

No previous LERs related to inoperable vital batteries were found. However, WBN, Unit 1 had a similar event regarding an unexpected degradation of the capacity of VB1. In May 2009, VB1 was replaced due to a capacity degradation trend. Prior to replacement, the battery capacity remained above the acceptance criterion of SR 3.8.4.14. The vendor concluded that improper curing of the battery cell plates was the likely cause of the earlier than expected loss in capacity.

C. Additional Information

None

D. Safety System Functional Failure

This event did not involve a safety system functional failure as defined in Nuclear Energy Institute (NEI) 99-02, "Regulatory Assessment Performance Indicator Guideline," Revision 5.

VII. ADDITIONAL INFORMATION (continued)

E. Loss of Normal Heat Removal Consideration

None

VIII. COMMITMENTS

None